Kangaroo Population Trends in the Australian Rangelands, 1980–87

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EXTENSIVE AERIAL SURVEYS OF KANGAROO populations are carried out annually over the Australian mainland, and three times in the period 1980–87 they have been over a sufficiently wide area to examine population levels and trends on a national scale.

The first national surveys in 1980–82 (hereafter referred to by the median year of 1981) covered 75% of the continent (Fig. 1) and included most of the range of the three large kangaroo species (the Red Kangaroo *Macropus rufus*, Western Grey Kangaroo *M. fuliginosus* and Eastern Grey Kangaroo *M. giganteus*). Caughley, G. *et al.* (1983) reported a total population estimate for the three species in the surveyed area of 15.1 million, advanced a 'plausible guess' of 4 million Eastern Greys in the unsurveyed Great Dividing Range of Victoria, New South Wales and Queensland, and proposed a 'tentative overall estimate' of 19 million kangaroos for mainland Australia in 1981.

The second set of surveys in 1984 excluded areas where 1981 kangaroo densities were very low (mainly deserts) and, while covering only 55% of the 1981 survey area (Fig. 1), encompassed areas which contained 97% of the 1981 surveyed population. By assuming that changes within areas common to the 1981 and 1984 surveys would be representative of changes in the entire 1981 area, Grigg *et al.* (1985) proposed a comparable mainland estimate for the three species in 1984 of 13.3 million kangaroos. Those authors stressed that the two estimates gave a realistic indication of trends but underestimated population levels, because correction factors developed by Caughley, G. *et al.* (1976) had recently been shown to be too low for Western Grey Kangaroos (Short & Bayliss 1985; Short & Hone 1989).

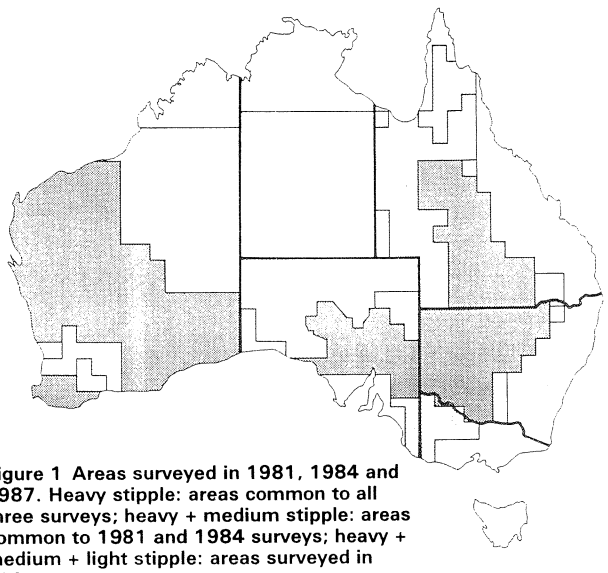

Figure 1 Areas surveyed in 1981, 1984 and 1987. Heavy stipple: areas common to all three surveys; heavy + medium stipple: areas common to 1981 and 1984 surveys; heavy + medium + light stipple: areas surveyed in 1981.

This paper presents results from a third set of extensive surveys, flown in 1987, and makes comparisons with the previous two surveys. The 1987 surveys were slightly less extensive than those of 1984 (Fig. 1), concentrating on the rangelands where kangaroo density is highest, where commercial harvesting occurs and, hence, where the need for regular monitoring is greatest.

We chose not to calculate a mainland population estimate by extrapolating to areas unsurveyed since 1981, as did Grigg *et al.* (1985), because with the passage of time from the 1981 survey such extrapolation becomes increasingly tenuous. We were also hesitant to extend the 'plausible guess' of Caughley, G. *et al.* (1983) to the eastern highlands because it has no rigorous quantitative basis. Instead we have examined population trends for the areas common to all three surveys, which comprised 2.5 million km^2 or 43% of the 1981 surveyed area, and encompassed areas which contained 89% of the 1981 surveyed populations.

Methods employed for the three surveys were identical, and the same organizations and observers (in most instances) were involved. As for the two previous surveys, population estimates were obtained using the correction factors of Caughley, G. *et al.* (1976). Since recent work has shown these correction factors to be too low for Western Grey Kangaroos (by factors within the range of 2–7, depending on habitat), and the same is likely for Eastern Grey Kangaroos given strong similarities in appearance, population estimates for Grey Kangaroos reported here will be too low. Our retention of those original correction factors is to allow direct comparison of trends between surveys, with the estimates for Grey Kangaroos treated as density indices. Within the area of sympatry, counts of the two Grey Kangaroo species (unreliably distinguished from the air) were distributed to either Western or Eastern Grey totals in proportion to their relative abundances reported by Caughley, G. *et al.* (1984). Our calculation of Western and Eastern Grey population estimates for 1987 was based on the assumption that the relative abundances of the two species has not changed significantly since the survey reported by Caughley, G. *et al.* (1984).

Results for areas common to all three surveys are given in Table 1, broken down by species and state. Trends from 1981 to 1984 in the common areas are very similar to those reported by Grigg *et al.* (1985). Total populations declined by 22% for Reds and 34% for each of the two Grey species, but trends were not consistent over the continent. Decreases occurred throughout the eastern pastoral zones, being most pronounced in New South Wales (declines of 57% for Reds, 72% for Western Greys and 54% for Eastern Greys) and least pronounced in Queensland (declines of 2% for Reds, 47% for

Western Greys and 17% for Eastern Greys). Declines in these areas and in the South Australian pastoral zone corresponded with the 1982–83 drought. In contrast, rainfall conditions in Western Australia were good in the period 1981–84, and populations rose by 99% (Reds) and 57% (Western Greys).

From 1984 to 1987 rainfall was generally average to good across all pastoral areas and most populations have shown substantial increases. In the eastern states New South Wales again showed the most pronounced response (increases of 67% for Reds, 233% for Western Greys and 96% for Eastern Greys) and Queensland the smallest response (increases of 10% for Reds, 38% for Western Greys and 40% for Eastern Greys). In Western Australia Red Kangaroo numbers rose by 17% and Western Grey numbers declined by 2%.

The increases in population size from 1984 to 1987 are slightly larger, overall, than the declines that occurred from 1981 to 1984; the trend from 1981 to 1987 shows a slight increase for all three species (3% for Reds, 9% for Western Greys and 5% for Eastern Greys).

Our discussion of the population estimates in Table 1 has concentrated on trends rather than numbers because use of Caughley, G. *et al.*'s (1976) original correction factors underestimates Grey Kangaroo populations. Our decision not to include information from recent correction factor studies (Short & Bayliss 1985; Short & Hone 1989) was deliberate, as additional studies currently being undertaken will soon lead to further improvements in accuracy. We were concerned that use of 'interim' information could lead to confusion over population estimates. However, when current studies are completed we recommend a thorough review of correction factor information and application of this information to aerial survey data.

The aerial surveys reported here contribute proximately to management of the commercial harvest of kangaroos in the rangelands. An essential component of that management is the monitoring of population trends. Although other monitoring techniques, both direct (ground survey) and indirect (analysis of harvest trends), are used to varying degrees by State wildlife authorities, aerial survey is the most widely applied technique in the rangeland situation. Information from these monitoring procedures, together with other relevant information such as weather and rangeland conditions, is used to set commercial quotas each year. The commercial quota is the maximum number of animals that may be taken for commercial use. Over the period 1981–87 quotas for Red, Eastern Grey and Western Grey Kangaroos have generally tracked the population trends derived from aerial survey: the combined total quota for Red and Grey Kangaroos of 2.53 million in 1981 was reduced to 1.58 million in 1984 in response to the 1982–83 drought and related decline in kangaroo numbers, then gradually increased to 2.71 million in 1987 as conditions improved and kangaroo populations rose. In each year the number of kangaroos taken has been less than the total quota, with total annual harvests representing 58%, 80% and 88% of the 1981, 1984 and 1987 quotas, respectively.

The ultimate benefit of regular broad-scale surveys will be a better understanding of kangaroo population dynamics. Aerial survey has shown that population levels can fluctuate in response to climatic conditions and that the intensity of the response can vary in both time and space. A first step in understanding these responses has been the development of numerical response models from aerial surveys in New South Wales (Caughley, J. *et al.* 1984; Bayliss 1985) and South Australia (Cairns *et al.* 1988). Development of similar models from Queensland and Western Australian aerial survey data to allow regional comparisons, and fine-tuning of the models from regular surveys in the near future, would further improve our ability to predict responses of kangaroo populations to climatic events. A practical outcome of this knowledge might then be a reduction in the frequency or intensity of aerial surveys, thus freeing resources for other important wildlife management problems.

TABLE 1 Kangaroo population estimates in 1981, 1984 and 1987 within areas covered by all three surveys. Note that, as discussed in the text, the values given for Grey Kangaroos are likely to be considerably underestimated.

Species	State	1981	1984	1987
Red	QLD	1 361 000	1 333 000	1 466 000
	NSW	3 837 000	1 663 000	2 770 000
	SA	1 138 000	745 000	963 000
	WA	1 004 000	1 993 000	2 329 000
Total		7 340 000	5 734 000	7 528 000
Western Grey	QLD	104 000	55 000	76 000
	NSW	876 000	242 000	806 000
	SA	198 000	91 000	208 000
	WA	424 000	666 000	652 000
Total		1 602 000	1 054 000	1 742 000
Eastern Grey	QLD	2 468 000	2 040 000	2 863 000
	NSW	2 010 000	929 000	1 824 000
	SA	—	—	—
	WA	—	—	—
Total		4 478 000	2 969 000	4 687 000

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